Modeling the spreading of glacial melt water from the Amundsen and Bellingshausen Seas

Yoshihiro Nakayama[1], Ralph Timmermann[1], Christian. B. Rodehacke[2], Michael Schröder[1], Hartmut H. Hellmer[1]

1 Alfred Wegener Institute, Bremerhaven, Germany
2 Danish Meteorological Institute Copenhagen, Denmark

The ice shelves and glaciers of the West Antarctic Ice Sheet (WAIS) are rapidly thinning, especially in the Amundsen Sea (AS) and Bellingshausen Sea (BS). The high basal melting of these small ice shelves is caused by relatively warm Circumpolar Deep Water (CDW) that, based on observations, mainly intrudes via two submarine glacial troughs located at the eastern and central AS continental shelf break. When CDW reaches the grounding line of the fringing glaciers, strong basal melting supports a buoyant melt water plume. As the glacial melt becomes part of the AS shelf circulation, it may cause a freshening of the shelf water locally as well as remotely in the Ross Sea (RS). To test whether the observed freshening of the RS is a consequence of the enhanced basal melting of AS ice shelves, we use Finite-Element Sea-ice/ice-shelf/Ocean Model (FESOM) with a horizontal resolution of 2-10 km on the AS and BS continental shelves. The model is forced with 6-hourly atmospheric data from the National Centers for Environmental Prediction Climate Forecast System Reanalysis (NCEP-CFSR). The model results show realistic bottom temperatures and basal mass loss rates of the ice shelves in the AS and BS. Using several independent virtual passive tracers to identify pathways of the glacial melt, we find that the melt water from the ice shelves in the AS flows towards the Ross Ice Shelf front. After 10 years of simulation, about half of the melt water in the RS originates from the Getz Ice Shelf. Further, we investigate how the strength of the basal melting influences the melt water transport into the RS.

Modelling of ice and polar ocean (*California Dreamin')*